

# **Assessment of climate change impacts and issues to support the making of new Nông thôn Mới (Vietnam's National Target Program on New Rural Development) criteria for the 2021-2030 Strategy**

Working Paper No. 328

CGIAR Research Program on Climate Change,  
Agriculture and Food Security (CCAFS)

Bui Le Vinh  
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Nguyen Cong Thang  
Nguyen Ngoc Luan



RESEARCH PROGRAM ON  
**Climate Change,  
Agriculture and  
Food Security**



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# Abstract

This report showcases the results of the assessment conducted by the Vietnam National University of Agriculture, International Center for Tropical Agriculture, and the Institute of Policy and Strategy for Agriculture and Rural Development. The assessment aims to create new sets of criteria for the Nông thôn Mới (NTM) program of Vietnam by investigating the impacts and issues brought by climate change. This is a part of the task, “Investigation and improvement of the national NTM criteria for rural development at all levels (commune, district, province) according to titles (standard, advanced, demonstration) in the period of 2021-2025.”

As of 2018, agriculture remains a major economic contributor in Vietnam, accounting for 14.68% of the gross domestic product. This puts the country at risk as the sector is highly vulnerable to climate change impacts. Climate scenarios for the future are not promising too as the annual average temperature is expected to increase, alongside annual rainfall. Together, these two impacts can lead to rising sea levels, which threatens the lives and livelihoods of coastal communities. These are only a few of the expected impacts of the changing climate that the Vietnamese government is trying to address.

The NTM is a national development program in Vietnam, which aims to enhance the resilience of rural communities to climate change impacts. The program is launched based on the lessons and experiences of implementing climate-smart agriculture (CSA) options in Climate-Smart Villages (CSVs) in Southeast Asia. CSA options, including technologies, practices, services, and approaches, were implemented to not only boost the communities’ resilience against climate change, but also reduce their greenhouse gas emissions and remain productive in the farms.

The researchers found out that six NTM criteria can accommodate agriculture and climate change adaptation and mitigation. These are (1) planning; (2) irrigation; (3) electricity; (4) communication and telecommunication; (5) production organization; and (6) culture. Several indicators were also proposed to fully integrate agriculture in the climate change context into the NTM program. The indicators are grouped into CSA solutions, climate services, irrigation, and adaptation plan.

## Keywords

*National development; climate change; adaptation; mitigation.*

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## Acronyms

ASEAN	Association of Southeast Asian Nations
CC	climate change
CIAT	International Center for Tropical Agriculture
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CGIAR	Consultative Group for International Agricultural Research
CSA	climate-smart agriculture
GDP	gross domestic product
VNUA	Vietnam National University of Agriculture
CSV	Climate-Smart Village
NAPCC	National Action Plan on Climate Change
NGO	non-government organization
NOMAFSI	Northern Mountainous Agriculture and Forestry Science Institute
NTM	Nông thôn Mới
RCP	Representative Concentration Pathway
SAPCC	State Action Plan on Climate Change
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change

# **1. Overview of climate change impacts on agricultural production and solutions to improve adaptation in the world**

## **1.1 Climate change**

Climate change (CC) is one of humanity's biggest challenges. It brings serious global impacts on production, life and environment, encompassing increased temperatures, flooding due to sea level rise, and saltwater intrusion affecting agricultural production. CC impacts will threaten industries and socio-economic systems, affecting sustainable development and global security in terms of energy, water, food security, societal stability, employment, diplomacy, culture, economy, and commerce.

Among the sectors being affected by CC impacts, agriculture is the most vulnerable due to its heavy dependence on favorable climate patterns and weather conditions. Agricultural development is considered a solution but is hard to achieve in the context of worsening CC impacts. With the inherently difficult challenges in the sector, climate change adds pressure and adversely affects many people who depend on agricultural livelihoods.

Ritter and Aguiar (2019) stated that the economy of rural communities is linked to agricultural, forestry, and fishery activities. Their dependence on these activities makes them susceptible to the impacts of extreme weather events such as rising temperatures, droughts, floods, wildfires or other diseases and insects developing in hot and humid weather conditions. Climate actions in these rural areas also face difficulties due to the gap between the residential areas and underdeveloped public transportation. Building sustainable rural communities to adapt to climate change and disaster prevention in the immediate and long-term periods is necessary to help reduce their vulnerability and increase their resilience.

## **1.2 Developing agriculture and rural areas under climate change**

Climate-smart agriculture (CSA) is an integrated approach that can address climate challenges and in turn foster agricultural development and food security (Bui et al. 2019). The Food and Agriculture Organization of the United Nations (FAO) publishes a reference book (FAO 2013) on CSA, which details 18 related topics and presents CSA goals. It focuses on important solutions to achieve CSA goals such as agroforestry, sustainable landscape planning, rational water use management, land protection and improvement, smart energy using in agricultural production, conservation of indigenous genetic resources and biodiversity, and sustainable crop and livestock systems. In addition, the book emphasizes the need to develop value chains, create flexible institutions and finance and effective mechanisms, improve community resilience, and monitor and evaluate the extent of CSA implementation.

At the United Nations (UN) Summit (2014), then-UN Secretary General Ban Ki-moon announced the establishment of the Global Alliance for Climate-Smart Agriculture (GACSA) chaired by FAO. Vietnam is a member-country of the GACSA network, wherein the Digital Agricultural Cooperative is an

official partner from Vietnam. Since then, UN has collaborated with governments, donors, and research and development organizations to implement climate change adaptation agriculture (or CSA) all over the world to achieve the three main CSA targets (FAO, 2013):

- (i) Ensure sustainable growth in production and income (Productivity);
- (ii) Improve climate resilience (Adaptation); and
- (iii) Reduce or eliminate greenhouse gas emissions (Mitigation).

### **1.2.1. China and modern agricultural development**

Major projects in cooperation with countries affected by climate change have been implemented since late 2013. Specifically, the **Integrated modern agricultural development project**<sup>1</sup> was cooperated between the World Bank and the Chinese government with a total capital of USD 313.4 million from December 2013 to December 2019. The project aims to develop climate-adaptive agricultural systems in some vulnerable geographic areas. Its activities are divided into four main components:

- (i) Improving agricultural infrastructures for cultivation and efficient irrigation systems. This component aims to strengthen irrigation capacity by improving water efficiency and applying water-saving techniques.
- (ii) CSA practices are implemented through improved irrigation infrastructure and water supply activities, boosting the productivity of irrigated agriculture, increasing farmer incomes, and reducing risks to extreme climatic patterns.
- (iii) The institutional strengthening and capacity building component seeks to enhance the capacity of farmers, farmer organizations, and other groups at various levels to implement sustainable agriculture and better response to climate change.
- (iv) The project management support component will provide support packages to project implementation agencies at each level to manage, implement, and monitor activities and progress.

In October 2005, the Chinese Communist Party launched the New Rural Construction Program with the following objectives:

- Economic: Comprehensively develop production capacity in rural areas, increase income for farmers, and narrow the rich-poor gap in urban and rural areas.
- Political: Enhancing education and improving the democratic capacity of farmers to strengthen the rule of law in rural areas, giving more ownership to farmers.
- Cultural: Investing in developing cultural institutions and enhancing cultural and spiritual activities for rural communities.
- Social: Increasing investment to universalize education and vocational training and improve the quality of health care services and social security in rural areas.
- Legal: Complete the legal system to better support the construction of the new countryside and

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<sup>1</sup> <https://projects.worldbank.org/en/projects-operations/project-detail/P125496?lang=en&tab=overview%2520>

carry out propaganda activities to improve the knowledge and practice of laws, as well as the rights and obligations of rural people.

After more than 14 years, China has garnered major achievements from the New Rural Construction Program:

- Agriculture has created many agricultural products with high economic value such as food, livestock products, natural rubber, and fruits.
- The number of large enterprises and cooperatives in the agricultural sector increased significantly. By 2010, there were more than 1,100 large enterprises and cooperatives with a total turnover of 150 billion yuan.
- The target of "one village, one business; one town one product" has been strongly developed and created many jobs for rural people.
- The Chinese government has provided vocational training to 50 million farmers to implement a rural labor transfer policy.
- The rural agricultural economy has developed strongly. By late 2016, the total value of agriculture, forestry, and fishery production reached 63,671 billion yuan (compared to 27,000 billion in 2006); total food production 616.24 million tons; cotton 5.34 million tons; oil plants 36.13 million tons; meat production 85.4 million tons; and milk 36.02 million tons.

#### **1.2.2. Republic of Korea and the new rural construction movement**

As a modern industrial country, Korea must also face the impacts of climate change in agricultural production and food systems at a national scale (Won et al. 2019). Some of the major climate indicators between Korea and the world are shown in the climate change scenario up to 2100 based on their Representative Concentration Pathways (RCPs).

South Korea's rice production is predicted to fall by 17.8% in 2050 under the RCP 8.5 scenario; soybean by 21.2%; and barley by 13.7%. If this scenario happens, Korea will need to import nearly half of the nation's total rice demand (Won et al. 2019).

To overcome this, the Korean government has established systems to forecast and monitor the impact of climate change on agriculture and fisheries. These systems include developing vulnerability assessment maps for each geographical region and each manufacturing sector, analyzing climate impacts and forecasting appropriate changes in agricultural production structure, and establishing a real-time monitoring system for marine and fishery resources for 28 coastal areas.

These national actions have brought some positive effects. Farmers have paid more attention and have applied the response measures to the impacts of climate change. As of 2015, 82.8% of farmers have said they have focused on the impacts of climate change and 83.8% have stated that those impacts were bad for agricultural production. These results are higher compared to 2009 data, which are 76.9% and 73.7% respectively. For response activities, 20.1% of farmers indicated that they had started or considered implementing countermeasures such as crop rotations with varieties of plants with a period of growth and development that is more suitable to changing weather patterns (14.1%),

participate in natural disaster insurance program (13.7%), switch to new plants (13.6%), and apply pesticides and herbicides depending on weather conditions (11.0%).

**Table 1. Temperature rise to 2100 between Korean and the world based on different Representative Concentration Pathway (RCP) scenarios**

	Korean	The world average
<b>RCP 2,6<sup>a</sup></b>		
Rising temperature (°C)	+1.8°C	+1.3°C
Raising precipitation (%)	+5.5%	+2.4%
<b>RCP 6,0<sup>b</sup></b>		
Rising temperature (°C)	+3.0°C	+2.7°C
Raising precipitation (%)	+6.8%	+3.6%

Source: KMA (2017)

<sup>a</sup>RCP 2.6: The climate change scenario assumes that greenhouse gas emissions from human activities are eliminated - which is almost impossible to achieve (level of concentration of CO<sub>2</sub> in the atmosphere at 2100 = 420 parts per million).

<sup>b</sup>RCP 6.0: The climate change scenario assumes the application of science and technology and strategies to reduce greenhouse gas emissions to achieve intermediate emissions (concentration of CO<sub>2</sub> in the atmosphere at 2100 = 670 parts per million).

In Korea, the New Village Movement (*Saemaul Undong*) was launched in April 1970 (Anh et al. 2016) with the original purpose of developing the Korean rural society. The Movement later spread across the country and contributed to the prosperous economic development in Korea. Implementation is the key to the success of the New Village Movement. It combines government support and self-reliance of the villagers through rural development projects. Projects are implemented in a three-step process: (i) select necessary projects based on baseline surveys close to local development conditions and needs, (ii) involve the people and related partners; and (iii) assess the project to determine achievement level and identify the issues to be addressed. Projects are built based on existing points, local needs, and development potential, thereby creating positive impacts sustainably and creating spillover power in communities.

### 1.2.3. India and the national goals of climate change adaptation

India is also a highly dependent country on agriculture, accounting for about 20% of the national economy (FAO 2017). Up to 700 million Indians live directly in the countryside and their livelihoods depend directly on agriculture, forestry, fisheries, and natural resources such as water and biodiversity (Satapathy et al. 2011). This high dependence on agriculture makes Indian rural areas sensitive to climate change as well. According to the Government of India's National Communications Report (GoI 2004), by 2100, climate change could affect India in terms of the following:

- Decreasing snow cover will affect the amount of melting ice from the glacial systems, 70% of which accounts for the water flowing in the Ganges River and the Brahmaputra River.
- The erratic monsoon phenomena will affect rainfed agriculture in India. Likewise, low rainfall in the future will affect both domestic water supplies and water for power production.

- Wheat production will decrease by 4-5 million tons when the average temperature increases by 1oC.
- Rising sea levels will affect the daily life of the world's most populous coast. Also, freshwater resources and mangrove ecosystems will be threatened by seawater intrusion deep into the mainland.
- Flooding will increase in frequency and intensity. This will increase the vulnerability of people in coastal, midland, and semi-desert areas in the country.

In June 2008, Prime Minister Manmohan Singh announced the National Action Plan on Climate Change (NAPCC) for India. Accordingly, all Indian states have prepared individual State Action Plans on Climate Change (SAPCC) to operate the NAPCC. The NAPCC outlines India's plans to address national climate concerns while simultaneously implementing the country's development goals. The plan includes eight core missions to address climate change adaptation and mitigation issues in different areas (Harshal T. Pandve 2009):

The National Solar Mission promotes the development and use of solar energy for power generation and other uses. Its ultimate objective is to make solar energy competitive with fossil-based energy options.

- The National Mission for Enhanced Energy Efficiency aims to implement a host of programs that will improve energy efficiency in the energy-consuming industries and sectors.
- The National Mission on Sustainable Habitat promotes energy efficiency as a core component of urban planning.
- The National Water Mission sets the goal of a 20% improvement in water use efficiency through pricing and other measures.
- The National Mission for Sustaining the Himalayan Ecosystem aims to conserve biodiversity, forest cover, and other ecological values in the Himalayan region.
- The National Mission for a "Green India" focuses on the afforestation of 6 million hectares of degraded forest lands and the extension of forest cover from currently 23% to 33% of India's territory.
- The National Mission for Sustainable Agriculture supports climate adaptation in agriculture through the development of climate-resilient crops, the expansion of weather insurance mechanisms, and innovative agricultural practices.
- The National Mission on Strategic Knowledge for Climate Change seeks to establish a better understanding of climate science, impacts, and challenges

The promulgation of NAPCC has enabled the rapid institutionalization of climate in the government. Central ministries responsible for the eight national missions embark on developing policy frameworks and implementation guidelines immediately (Dubash and Ghosh 2019). This process takes place separately in the ministries responsible for each mission and is supported by specialized offices. Some missions, such as that on sustainable agriculture adapting to climate change, has specific goals with a focused strategy, i.e., build the agricultural sector appropriate to the current climate change situation.

Other missions, such as the national water mission, have a wide impact on many relevant ministries and agencies in national planning. In the implementation process, the approach between missions is a mixed bag (Byravan and Rajan 2012). The diversity of scale and scope and the broad structure of the missions has led to criticisms that the NAPCC does not have a consistent vision and plan. This is difficult in identifying specific targets according to the evaluation criteria. Moreover, while the co-benefit method provides the overall framework, the specifications of specific co-benefits do not appear. Missions tend to create wish lists than to crafting strategies with direction.

After NAPCC was operationalized in 2010, India's Ministry of Environment and Forests also provided a common policy framework to support the SAPCCs (Satapathy et al. 2011). Accordingly, the Ministry offers invitations to development agencies such as the German International Cooperation Association (GIZ), the United Nations Development Program (UNDP), the United Kingdom Department for International Development (DFID), and the World Bank, to assist states in crafting policies appropriate to their contexts. A SAPCC identifies and prioritizes policy solutions on adaptation and mitigation of climate change impacts. In particular, plans were developed through a participatory planning process of all key stakeholders, including government agencies, policymakers, scholars, non-government organizations (NGOs), scientists, private companies, civic organizations, and local communities.

Positive policy directions reflect the growth in organizations responding to climate change. Spaces have been created within existing ministries and departments, and through new interdisciplinary agencies to devise strategies for climate issues and develop or deepen interdisciplinary linkages. However, the government's institutional capacity on climate issues remains low and needs to be significantly strengthened for substantive engagements. As India strengthens its efforts to mainstream climate change into its development agenda, climate policymaking will continue to be promoted or limited by domestic decisions and by the country's institutional capacity influencing political decision making. The emphasis of India's overall climate policy is expected to be sustainable development with reductions in greenhouse gas emissions or mitigation of impacts as a co-benefit.

#### **1.2.4. Policymaking in the Democratic Republic of Congo**

In developing Central African countries such as the Democratic Republic of Congo, a major hindrance to development is the sensitivity of livelihoods (e.g. agriculture production, energy, water, and health) and the overall economy of the people to climate patterns and weather conditions. This makes the country's development always accompanied with climate adaptation. Congo is a large country located on the equator; the climate in this country is quite diverse, ranging from hot, humid climate in the northern Congo River basin to cool dry climate in the southern highlands (DRC, 2018). According to Sonwa et al. (2011), as much as 80% of the country's population is dependent on agriculture and forestry for their livelihoods. Manufacturing activities in this sector contribute more than 70% of Congo's gross domestic product (GDP). Therefore, integrating climate change adaptation factors into national agroforestry planning is the key to strengthening policy coherence and efficiency in management and economic growth.

According to Ludwig et al. (2013), by the end of the 21st century, the Congo River Basin will be drier and the water flow will decrease by 5%-15% due to the impacts of climate change. However, agriculture in this area may not be affected too much if the water level has only decreased to this extent. Agriculture in the vicinity of the Congo River basin will be marginally affected by drought at some point when rainfall is in short supply and will improve when the rainy season comes. Only the steppe areas of southern Congo are the most affected, as the region is usually drier than other parts of the country. Moreover, the temperature change will affect crop yields, as well as the management of pests and diseases in agricultural production.

As one of the least developed countries and most vulnerable to the impacts of climate change, Congo has proactively launched National Action Programs to adapt to climate change (NAPAs) (Sonwa et al. 2011). Accordingly, actions towards integrating adaptation and mitigation activities and strategies in national climate change policies have been emphasized, especially in the forestry sector. Like most sub-Saharan African countries, forests are an important component in mitigating the impact of climate change. Balancing the role of forests to mitigate and adapt to climate change will then require appropriate policies and institutional arrangements for management, practice, and resource consumption.

However, the integrated activities that Congo has carried out are mainly aimed at mitigation; less attention was given to adaptation (World Bank 2004). To address this issue, the country organized scientific policy dialogues to improve the quality of interaction between many stakeholders in the sharing of goods and services provided by forest ecosystems. This is essential for cooperation and consensus-building.

Climate change has been recognized as a threat that could undermine years of development efforts in the Congo basin (Brown et al., 2010); responsive plans with the participation of policymakers are essential. Due to the lack of mechanisms to integrate scientific knowledge into the policies of the Congolese Government, results of scientific research are often carefully selected at the discretion of policymakers. Through policymaking dialogues, selective processes for research results are informed and selected by both researchers and policymakers. Policymakers will be able to use more research results to provide evidence-based information and to engage researchers more openly in the process of developing a range of policy options. Given the projected impacts of climate change on tropical forests and dependent communities, the relevance of scientific information to sound development policy must be communicated.

As a first step in mobilizing regional participation and attracting partners from various organizations, the Center for International Forestry Research (CIFOR), with funding from the European Commission, organized a knowledge-sharing workshop for stakeholders to identify issues and needs and devise strategies to respond to climate change and in particular identify adaptation measures in the Congo basin. The workshop brought together at least two representatives from the countries surrounding the Congo basin to Yaoundé, Cameroon on July 23, 2007.

The participants included representatives of regional organizations such as the Central African Ministerial Commission for the Forest (COMIFAC), Central African Regional Partnership for the



Environment (CARPE), all national focal points from the United Nations Framework Convention on Climate Change, national research organizations, NGOs, universities, and community groups. The workshop recognized that the region needs an immediate climate change strategy and gaps limiting the responsiveness of the region should be identified. These outcomes represent the shared views of a range of stakeholders and actors that are directly involved and responsible for policy, research, and development practices on climate change-related activities (Sonwa et al. 2011).

The second scientific policy dialogue took place during the opening meeting of the Congo Basin Forest and Climate Change Adaptation (COFCCA) in Yaoundé in June 2008 (CIFOR 2008). Participants in this meeting include governments, forest management boards, climate management boards, researchers, educational managers, civil society organizations, village leaders, economic executives, NGOs, and regional organizations. The presentations in this meeting revolved on three main topics:

- level of climate change in the Central Africa region;
- impacts of climate change on forest ecosystems; and
- impact of climate change on local communities and their coping strategies.

These presentations are intended to provide background information on climate change in Central Africa and are relevant to the current situational analysis of the links between forests and climate change in the region. Identifying and prioritizing climate-sensitive areas are carried out nationally with all stakeholders. After these processes at the national level, all sectors have been combined and re-decentralized across the three countries for common priority areas in the region. The selected priority areas have been used to further develop project activities in the area.

#### **1.2.5. Formulating development policies and strategies in Thailand**

Thailand, a country of about 65 million people, most of whom live in rural areas and engage in agricultural production, remains the world's largest rice exporter (Marks 2011). Agriculture employs 49% of the population and contributes 10% of GDP. Tourism and fisheries are very popular with the 3,200-km long coastline playing an important role in the economy, providing 6% of GDP and livelihoods for 10% of the population. Bangkok is home to 15% of the population and is an economic, political, and social center not only for Thailand but also for the Mekong region, creating the status of a global city. Climate change threatens all three important areas of the Thai economy: agriculture, tourism, and trade.

The Office of the National Economic and Social Development Council (NESDB 2016) reported that the average annual temperature in Thailand increased by about 1°C from 1981 to 2016, and the summers lasted two to four weeks longer than usual in previous years. Moreover, the number of rainy days and the level of rain in Thailand has decreased in the last 50 years. In 2010, Thailand faced the worst drought in 20 years, resulting in the Mekong River's water level falling to its lowest level in 50 years. The impact of climate change on Thailand has been serious and will likely cause or worsen some of the issues over the next few decades. These include water management challenges, increasing tensions and gaps between the rich and the poor, damage to the tourism industry, and conflicts with China over dam-building policies.

Although the government has begun to frame policies to adapt and mitigate climate change, its response has so far been limited by gaps in both planning and implementation. The ongoing political crisis in Thailand has also made decision-makers aware of this issue. In the coming decades, Thailand's institutional and political economy will hinder its ability to tackle climate change. Also, the building of the country's capacities due to democratization will not be enough (Marks 2011).

In April 2007, Bangkok hosted the International Summit on Climate Change. Also, Thailand and the United Nations organized International Climate change Negotiations. Following these conferences and negotiations, the Bangkok Metropolitan Administration published the 2007 Action Plan on Global Warming Mitigation, calling for reductions in Bangkok's greenhouse gas emissions by 15% below currently projected 2012 levels (Kisner 2008). Accordingly, most officials, NGOs, academics, and some private sector leaders agree that Thailand should limit its greenhouse gas emissions. Thailand's level of emissions is high compared to the level of economic development in 2007. The country contributes about 1% of global emissions. By comparison, Vietnam only emits 0.4% while Indonesia emits 1.3%. Soon, as countries seek to cut carbon emissions, Thailand will be pressured to comply.

The government's response to climate change has improved but is still limited. On the positive side, in 2006, the government established the National Committee on Climate Change, followed in 2007 by the establishment of the Climate Change Office Coordination (OCCC) of the Ministry of Natural Resources and Environment and the Thailand Greenhouse Gas Management Organization (TGGO) to promote investment in mitigation activities. In January 2008, the government issued the National Strategy on Climate Change for 2008-2012. The strategic goals focus on building capacity to respond to climate change through raising public awareness, supporting research, strengthening government agencies, and reducing emissions. Most recently, the Thai Government also launched a strategy of "Green growth for sustainable development" to promote climate change response for the period 2017-2021 (NESDB 2016). Accordingly, the strategy focuses on 8 major goals:

- Conserving natural resources for green growth. These include: Conserve and restore forest resources; conserve and utilize biodiversity sustainably; set up land management system and resolve public land encroachment; protect marine and coastal resources; formulate a management plan for mineral resource.
- Managing water resources to achieve balance and sustainability. These include: supporting the development of a master plan on water resources; improving the efficiency of the entire sustainable water management system; ensuring water security and equity in water consumption and production; applying the environmental assessment strategy to ensure watershed development; and raising people's awareness about the importance of water resources.
- Promote sustainable consumption and production. These include: promoting green industrial production and investment, supporting sustainable agricultural production, promoting sustainable tourism income, and catalyzing consumers to change behaviors towards sustainable consumption pattern.

- Solve for critical environmental problems. These include the following activities: (i) accelerate the management of solid waste with appropriate technology, focusing on crisis areas with high waste accumulation; manage solid waste at the origin; reduce the generation of wastes; increase separation for reuse and recycle; (ii) increase efficiency in water quality management; reduce wastewater from origin; develop and improve the efficiency of community wastewater collection and treatment; (iii) increase efficiency in air quality management; reduce and control pollution to comply with the standard of industry and transport source; and speed up the solution of Transboundary haze problem.
- Develop management system & resolution mechanisms for natural resource and environmental conflicts. These include improving the Environmental Impact Assessment (EIA) mechanism to be more efficient in all steps; pushing forward the use of Strategic Environmental Assessment (SEA) as a tool in decision making of key policy issues; enhancing public participation process in policymaking; and fostering the roles of private entities and communities to create synergy in protecting and restoring natural resources and environment.
- Increase potential in greenhouse gas reduction and enhance capacity in climate change adaptation. These include determining the direction of low-carbon development strategy; drafting the new laws and amend the existing ones on climate change; formulating measures and mechanisms to support GHG emission reduction; enhancing the capacity to adapt to climate change impacts; and building up knowledge, understanding, awareness, and participation of people and other stakeholders.
- Managing disaster risk reduction. Disaster preparedness planning at all levels; capacity building on disaster prevention and response; setting up of disaster management systems for emergency response; and setting up recovery systems after the disaster.
- Create international environmental partnerships. Promote the formulation of natural resource and environmental management plan for the Association of Southeast Asian Nations (ASEAN); seek collaboration within ASEAN and Mekong Sub-Region on trans-boundary logistics, labor movement, energy and haze management; create understanding and right practices on rules, regulations, and international agreements.

## **2. The impacts of climate change on the goals of agricultural production in the construction of new rural area of Vietnam and the limitations of capacity in adaptation and mitigation**

### **2.1. The impacts of climate change on Vietnam's agricultural sector**

As of 2018, agriculture accounts for 14.68% of the gross domestic product of Vietnam (General Statistics Office 2020). Vietnam is rated by the United Nations Development Program (UNDP) as a severely affected country by climate change, wherein the Mekong River Delta (MRD) is one of the

three deltas in the world most vulnerable to sea-level rise, next to the Nile Delta (Egypt) and Ganges Delta (Bangladesh).

According to the RCP4.5 climate change scenario (MONRE 2012), by the end of the 21<sup>st</sup> century, the annual average temperature in Vietnam could increase by 1.8 - 2.30C. The total annual rainfall also could increase compared with the period 1986-2005, while the dry season rainfall in some areas could decrease. By 2100, the average annual rainfall in most areas would increase by 5% - 15%. In some coastal provinces in the Northern and Central Plains, it may increase by more than 20%. This increases the risk of flash floods and floods in areas with high rainfall intensities leading to soil erosion (Nguyen 2014), while droughts would be more severe in areas with less rain.

Increasing temperatures and heavy rainfall could also cause a sea-level rise of about 0.75m to 1m compared to the period 1980-1999. If the sea level rises by 1m, there will be about 40% of the Mekong Delta area, 11 % of the Red River Delta area, and 3% of other coastal provinces flooded. In Ho Chi Minh City, over 20% of the area will be inundated. At the national scale, about 10-12% of the country's population is directly affected and national GDP can decrease by 10%.

According to Dat and Thu (2012), flooding will cause a loss of arable land in the two most important agricultural areas of Vietnam. The MRD is expected to lose 80% of arable land while the Red River Delta can lose 30 because they are 2.5m below sea level. Currently, Vietnam's cultivated land is about 9.4 million hectares (including 4 million hectares of rice). Nationwide, Vietnam will lose more than two million hectares of rice land (about 50%) if the sea level rises by 1m. According to Son et al. (2011), climate change can adversely impact and present risks to vulnerable sectors such as agriculture, food security, natural resources, and health. As a response, in recent years, Vietnam has actively implemented disaster risk management and climate change adaptation in both directions, i.e. the national level and the local levels. Feedbacks of each locality from the district and commune levels will be reflected to higher levels (province, region) to adjust strategies, promoting a two-way interaction (Tri et al. 2015).

## **2.2. The limitations in adaptation and mitigation of climate change impacts**

- **The process of new rural reconstruction is not closely linked with the restructuring of the agricultural sector**

Although infrastructure in localities has been focused on development, many places have not yet met the requirements of large-scale commodity agricultural development, especially in some specialized agricultural areas such as the Mekong River Delta and the Central Highlands (Ministry of Transport 2019). Also, the maintenance of the quality of infrastructure works after reaching standards in some localities has not been paid attention to, and the lack of regular maintenance leads to the degraded works.

- **Planning of infrastructure and production has little consideration of the impact of natural disasters**

In the NTM planning, construction consultancy units and commune officials lack the understanding of technical regulations and standards, which are needed to build climate-resilient infrastructure projects such as schools, clinics, bridges, and even high-risk areas. As a result, many newly completed constructions were destroyed after one extreme weather event (e.g., heavy rains or flash floods). Only a few localities are concerned with restoring and embellishing the drainage system in the residential areas. Many communes that often experience rains and floods also do not have a plan to create higher grounds in each hamlet to create temporary shelters for people and cattle when the need arises.

Agricultural production planning remains slow to adjust towards restructuring to increase added value and adapt to climate change. Basic agricultural production planning of the province and district has not been supplemented and adjusted according to the enhancement of added value/unit area and natural disaster prevention to adapt at the regional scale.

This means that the production planning of the communes is still tinkering or in the old direction. Examples include the stormy central provinces still planning to plant rubber trees; many provinces in the Mekong Delta with seawater intrusion such as Ca Mau still slowly shift rice to shrimp farming; and many low-lying areas in the Red River Delta still convert rice to perennial fruit trees without an accompanying adaptive irrigation system. Damages arise in these areas whenever a serious natural disaster occurs.

Migration planning for disaster-prone areas has received little attention and remains inadequate. Disasters such as floods, landslides in mountainous provinces are getting stronger and fiercer every year, especially in the northern mountainous region. Riverbank erosion in the southern provinces is prevalent, especially in the Mekong Delta. Most localities have warnings for dangerous areas. However, in the NTM planning, the communes have little or no mention of the migration planning for vulnerable areas. This work also lacks the guidance and involvement of their superiors.

- **The disaster prevention infrastructure for forecasting remains still poor and out-of-date**  
Despite the pouring of large investments through the years, many river dykes, sea dykes, and related constructions have not guaranteed flood protection. Many river dike systems are likely to break when saturated due to the rise of water level for a long time (7-10 days). In the Central region alone, there are nearly 1,000 deteriorated reservoirs, 50 dams of which are ready to burst anytime. The whole country has 2,500 reservoirs with less than 250 m<sup>3</sup> of water managed by the commune that are degrading without investment for strengthening.

The warning system against storms and floods--mainly funded by state budget--has recently been focused and quite effective in alerting people. Storm shelters for ships have been built and progressed. However, there are many limitations in the in-land warnings of high-risk areas. Many large dams, such as the Hoa Binh hydropower reservoir often receive false information of flooding water due to the low accuracy of rain monitoring devices, which leads to inaccurate flood discharge and irrigation activities. At times, urgent treatment of dams has caused great

damages to production in downstream areas. The areas at risk of landslides also have almost no measuring equipment that provides data on landslide susceptibility and landslide characteristics to proactively overcome or warn people to avoid and for the responsible authorities to make decisive responses promptly.

- **Resources for natural disaster prevention and control in communes are still limited and lack human resources**

The core forces in disaster prevention at the commune level (including leadership and volunteers) lack proper training and practice in natural disaster prevention skills, dealing with consequences of natural disasters. These forces are confused when dealing with extreme weather events, especially in terms of the coordination between groups to resolve cases in the area.

The funding importantly comes from the State budget. Social capital is often reserved for post-disaster relief. However, the State budget and social capital mobilized for proactive natural disaster prevention and control are very limited. The development of the disaster prevention and disaster risk insurance fund remains slow even if the agricultural insurance fund has been piloted for two years, confirming its success but does not seem to be expanded. The fund's basics are still inadequate in terms of fund structure, subjects of contribution, and contribution level, making it inaccessible for the people. Moreover, the results achieved are not significant.

- **Although rural environment pollution is a concern, significant changes have not been made**

Statistics show that there are 1,417 landfill sites, including garbage collection points, wherein only about 20% of landfills are hygienic. However, not all hygienic landfills have gas collection systems. Leachate treatment systems in many cases fail to meet national technical standards (MONRE 2019).

There are still many environmental problems to be resolved in trade villages. According to the report on the implementation of environmental protection for handicraft villages in some localities: Many trade villages have not invested in building environmental protection infrastructure. Solid waste, wastewater, and exhaust gas have not been completely treated, causing adverse impacts on the environment landscape and polluting the air, water, and soil environments. Many trade villages that process food and recycle scrap (e.g., paper, plastic, metal) generate a huge amount of solid wastes in their production chains. These wastes are not collected and treated but discharged directly in public areas, especially lakes and dikes, obstructing drainage systems, and serious pollution of surface and underground water, causing air pollution and deteriorating the view of rural landscape.

### 3. Climate-Smart Village - an effective tool in building new rural areas from 2021-2025

#### 3.1. Overview of the Climate-Smart Village model

The Climate-Smart Village<sup>2</sup> model (CSV) has been recognized by the Ministry of Agriculture and Rural Development of Vietnam in 2016 to promote CSA implementation in highly vulnerable rural communities. This model is integrated within the framework of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) (CCAFS 2020a), the largest global research program of the Consultative Group for International Agricultural Research (CGIAR<sup>3</sup>) network, and is coordinated by 15 research organizations<sup>4</sup>. The CCAFS program has been implemented in India and some South Asian countries, East Africa and West Africa since 2011, and in Latin America, Central America, and Southeast Asia (including Vietnam) since 2015. CCAFS conducts groundbreaking and transferable research activities to address agricultural development goals in the context of climate change. One of the important tools of CCAFS is to build and replicate the CSV model around the world to practice smart agricultural solutions and increase on-site resilience and climate change adaptation at the village level, thereby integrating research results with policy plans to replicate the model to broader geographical areas to increase the number of people and countries benefiting.

Aggarwal et al. (2018) have explained the goals of the CSV approach in each economic development plan, including the four points as follows:

- (i) Learn the effectiveness of CSA solution packages (including farming practices, farming techniques, services, support programs, and policies) to not only increase yields and income but also improve adaptation, resilience, and reduction of greenhouse gas emissions;
- (ii) Propose solutions to adapt and be resilient to the impacts of climate change in the future;
- (iii) Analyze and clarify natural, socio-economic, and gender constraints, as well as opportunities for adoption of adaptive and resilient solutions; and
- (iv) Implement solution packages, while creating more motivation for adoption through financial assistance, improving support through institutional change, and offering solutions for scaling implemented in a wider geographical range. These should be carried out in parallel with national and local development programs and plans.

These are also required to build economic development models applying the CSV model that each locality needs to consider before building the execution plan. Aggarwal et al. (2018) also pointed out five uses to support decision-making in implementing the CSV model for farmers and related partners, including:

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<sup>2</sup><https://baotainguyenmoitruong.vn/mo-hinh-nong-nghiep-thong-minh-ung-pho-voi-bien-doi-khi-hau-bai-1-lang-nong-thuan-thien-241803.html>

<sup>3</sup><https://www.cgiar.org/>

<sup>4</sup> <https://www.cgiar.org/research/research-centers/>

- (i) Agricultural land-use plans and contingency plans for local implementation should consider current and future climate risks, agro-ecological, social-economic conditions, and potential for market development.
- (ii) Assess possibilities of applying farming methods, farming techniques, implementation support programs linked to climate change contexts, and market demand to ensure feasibility in the long term.
- (iii) Guidelines for developing strategies to select CSA solutions, farming techniques, agricultural services and materials, and appropriate pre- and mid-crop support packages. The formulation of a production strategy should also consider the financial capacity, the availability of labor, and the market potential for agricultural products. The production strategy development should be done with the participation of farmers, irrigation department, extension workers, small businesses, and suppliers of agricultural materials.
- (iv) Guidance on the use of useful information about short-term weather forecasts, smart applications, modern techniques for saving water/fertilizer/energy, and agricultural insurance in the event of a “loss” season.
- (v) Guide to applying policy to overcome barriers and look for options for implementing CSA, including considering the financial need to replicate the model locally and at the national level.

The above uses need to be calculated to achieve the implementation of economic development models applying the CSV model and developing plans for replication to a larger geographical scope, for example, district, province, and country.

ICRISAT (2016), a CGIAR member, offers five approaches to help farmers better cope with climate change in the construction of CSVs, including (i) Good basin management; (ii) trees-pets prediction models; (iii) Agricultural and digital solutions; (iv) weather forecasting systems to improve resilience; and (v) adaptive solutions based on the results of accurate weather forecasts in the short to medium term.

At the inception phase of CCAFS at the global level, 27 CSVs were established in the study geographic areas (CCAFS 2020b), wherein three out of the seven CSVs in Southeast Asia were implemented in Vietnam. The CGIAR organizations in charge of each study site have developed a CSV process to implement climate change adaptive agriculture. The processes may not necessarily be the same at all points in terms of the number of steps taken, but overall, still need to include the following key steps (Aggarwal et al. 2018):

- (i) Learn about the effectiveness of climate change adaptive agricultural solutions (farming practices, science, and technology, services, programs, and policies) to not only increase yields and income but also increase adaptability and reduce greenhouse gas emissions;
- (ii) Building adaptive solution packages to adapt to future climate change risks;
- (iii) Identification of socio-economic resources and gender constraints to develop appropriate strategies to increase application rates; and
- (iv) Test solutions, find funding and collaborate to support implementation while looking for partners in building long-term plans for model replication.



To effectively implement the above steps, CGIAR scientists participating in the global CCAFS mission provide scientific methods and tools (CCAFS 2020c) that help implement activities and steps in establishing and replicating the CSV model most effectively. Some examples of typical methods and tools are: (i) Quick assessment of rural areas in selecting appropriate CSA Solutions (CCAFS 2020d) with citizen participation and support tool at the local level to rapidly assess the performance level of activities through a smartphone with an android operating system (CCAFS 2015a); (ii) Using scientific and technological advances to improve the quality of weather forecasting (CCAFS 2020e) and spatial planning (CCAFS, 2020f) for agroforestry policy-making in various countries and regions; and (iii) Using communication and information technologies (CCAFS 2020g) for gender research.

So far, several countries and regions have succeeded in introducing and replicating the CSV model. The most significant is India, a country with the 7th largest area and 2nd largest population in the world. From several CSV models of the CCAFS program, the Government of India has developed a national program with 500 CSVs (CCAFS 2015b) focusing on rice and wheat for a total area of nearly 240,000 hectares across five states. The total value for this program that has reached 140 million USD comes from the government budget. From West Africa, Senegal has successfully piloted a CSV model called Daga-Birame (Sanogo et al. 2017) from which a replication roadmap will be built. In South America, Osorio-García et al. (2019) had a detailed analysis of the collaborative process in the implementation of the CSV model in Cauca, Colombia.

### **3.2. Climate-Smart Village in Vietnam**

In Southeast Asia, the CSV model in Ma village, Vinh Kien commune, Yen Binh District, Yen Bai Province (Christina Larson 2016), implemented by CIAT<sup>5</sup>, is considered as one of the most successful CSVs in the region. Ma CSV has exhibited a successful establishment and experiment of the CSV model (Bui et al. 2015, 2016, 2017, 2018) and has connected with the National Target Program on New Rural Development at Central and Yen Bai Province in the replication of the model from 2019-2021. CIAT collaborates with local research organizations such as VNUA and Northern Mountainous Agriculture and Forestry Science Institute (NOMAFSI) in the stages of developing (2015-2018) and replicating (2019-2021) the CSV model in Yen Bai.

CIAT introduced the Ma CSV model in regional (Da Nang, July 2018; Dien Bien, July 2018; and Yen Bai, November 2018) and national NTM conferences (Vinh Yen 2018). This CSV model was evaluated by NTMs as an effective tool for climate change adaptation. The bottom-up approach of CSV was deemed effective in understanding the current situation of climate risk, the need for change, the receptivity potential to undertake on-site response actions, and adaptation. This approach helps the NTM program to allocate finance more effectively by properly assessing the capacity and need for building and enhancing capacity to respond to climate change for each locality.

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<sup>5</sup> International Center for Tropical Agriculture (<https://ciat.cgiar.org/>)

### 3.3. Evaluate the pervasive effects of the Ma CSV model and lessons in rural construction in disadvantaged areas to adapt to climate change in the NTM context from 2021-2025

Table 1 summarizes the sequence of steps, results, and impacts of the CSV model developed in Ma Village in Yen Bai Province. The results of the implementation of the project model over the past 4 years show that:

- The villagers have slowly participated in the activities and express more confidence in the project after initial skepticism and indifference. Their participation was encouraged by the successful implementation of agricultural solutions to adapt to climate change. Aside from participating in the project, the villagers were empowered to decide on the selection of suitable agricultural solutions. They discuss together to build interest groups, jointly develop plans, and actively comment on project activities.

Lesson: Increasing ownership and initiative among the people to decide on the activities regarding their production, life, and future will increase their commitment and promote their participation and their indigenous knowledge in achieving the objectives of any activity.

- The villagers are allowed to participate in policy dialogues with leaders of the Department of Agriculture and Rural Development of Yen Bai Province, the Division of Agriculture and Rural Development of Yen Binh District, and leaders of the People's Committee of Vinh Kien Commune to request for support to implement a climate-resilient agriculture. In these dialogues, the participants were expressive of their thoughts about local investment policies and proposed changes and more investments that are suitable to their conditions and needs. According to the villagers, there should be policies to guide investments in adaptation practices in a CSV environment to ensure the sustainability of adaptive capacity in disadvantaged and vulnerable rural areas.

Lesson: This is an effective bottom-up approach close to the situation of production and life in formulating and modifying policies to be more suitable and effective. The villagers - who are directly affected (either positively or negatively) by the policy - are the most relevant evidence in assessing the success of a policy in practice.

- The research team of CIAT, NOMAFSI, and VNUA, within the framework of the CCAFS FP2.1 project, conducted baseline studies, situational and capacity assessments (natural resources, production activities, social environment, people), and cost-benefit analysis to determine the feasibility of agricultural solutions proposed. All these were conducted to assess climate risks, need for change, availability, and new knowledge required, which includes the level of investment and the potential success of the capital in the early stages of the project. This has led to the unexpected success of the project with the lowest investment compared to the achieved project efficiency.

Lesson: Conducting baseline investigation, assessment of implementation capacity, and cost-benefit analysis of investments before implementing projects will help the NTM better allocate resources.

- Delegates from provinces participating in regional and national NTM conferences in 2018 have positively received the implementation results of the CCAFS FP2.1. They thought that the project's pragmatic approach was feasible and practical in building NTMs towards climate change adaptation and integrated agricultural production. The fact that the representatives of some northern mountainous provinces suggested to MARD to invest in two to three CSVs per province, which will then be scaled up, is a clear proof of the project's success and scaling potential.

Lesson: The CSV model needs to be transformed into an implementation process with fully instructive technical documents incorporated in some NTM criteria such as Criteria #13 on production from 2021-2025. This is mandatory for disadvantaged rural areas and agro-ecological regions highly affected by climate change, which will serve as the standards of advanced NTM and model NTMs.

Table 2. Summary of implementation orders, results, and impacts of the Ma CSV model from 2015-2018

	ACTIVITIES	RESULTS	PROJECT'S IMPACT
	<b>Propaganda and advocacy</b>		
.1	Organize seminars to share project ideas, identify climate risks and their impacts on agricultural production and rural life, and the urgency to seek and practice agricultural solutions that can adapt to climate change (Larson 2016; Sivagnanam 2016)	Some people only participated in the initial project activities because they were curious; some were even doubtful.	People are now more aware of climate risks and can connect by themselves the impacts of climate change to their livelihoods and agricultural production.
.2	Propaganda through competitions on environmental protection and conservation of genetic resources and indigenous biodiversity	<ul style="list-style-type: none"> <li>- People participated in fashion competitions made from plastic waste to propagate the reduction of solid waste into the environment</li> <li>- People who participated in the cooking contest used native crops and domestic animals to propagate the use of native solutions to increase resilience.</li> </ul>	<ul style="list-style-type: none"> <li>- A part of the residents' sense of environmental protection has been improved through the collection of plastic waste. However, the implementation is not thorough and requires government action by establishing a joint action campaign.</li> </ul>
.3	Upgrade infrastructure and support communication and propagation equipment <ul style="list-style-type: none"> <li>- Renovating a warehouse into a community library, including one agricultural extension bookcase, tables, and chairs, writing board, internet-connected computer, printer;</li> <li>- Investing in four loudspeaker system for the information to be conveyed to all villagers;</li> <li>- Building one weather bulletin board and seasonal calendar.</li> </ul>	The Ma villagers received the following facilities: <ul style="list-style-type: none"> <li>- Access to weather information, agricultural policies, and daily seasonal calendar through the loudspeaker system;</li> <li>- Technical information on agricultural solutions to adapt to climate change through agricultural extension documents;</li> <li>- Use the library space to conduct information-sharing activities and technical training.</li> </ul>	Ma village issued a set of regulations on the use of community libraries: <ul style="list-style-type: none"> <li>- Library is open thrice a week from 7-9 PM for people to read and look up information;</li> <li>- The use of the library for technical training sessions and professional activities should be registered with the village's Women's Union leader;</li> <li>- Ensure general hygiene and limit noise during library use.</li> </ul>
	<b>Searching, selecting, and experiencing technical models</b>		
.1	Cooperate with local people and officials to select potential agricultural solutions that lead to climate change adaptation and resilience in Ma CSV	One list of 15 CSA solutions, including: <ul style="list-style-type: none"> <li>- 10 solutions from the research team</li> <li>- five solutions from the people</li> </ul>	(1) <i>Straw incubation</i> : 100% of rice farming households do not burn straw after harvest (2) <i>Composting and raising earthworms</i> : no fresh manure piled up in the garden; farmers raise earthworms as food for chickens and fish and use compost to fertilize vegetables and crops (3) <i>ICM integrated rice cultivation solution</i> : farmers know how to apply the method of rice cultivation in large-
.2	Organize a workshop to select CSA solutions with the participation of the villagers, in which the research team develops one set of legal assessment criteria to help people understand and score the solutions (Bui 2018).	From 15 initial solutions, 10 solutions (Bui et al., 2015) were unanimously selected by the villagers	

	ACTIVITIES	RESULTS	PROJECT'S IMPACT
.3	Use economic tools to analyze the costs and benefits of the solutions selected in section 1.2 and find those with the highest scientific and practical basis to be produced.	The seven most feasible solutions after calculating costs and profits were developed by the research team into one mind map (Vinh et al. 2016) dividing the solutions into three groups that highlight the benefits of the solutions and the linkage between them to achieve maximum efficiency	narrow rows to overlap with winter vegetable crop in the condition of prolonged Summer-Autumn due to changing weather; Alternate Wetting and Drying (AWD) solution to save water for irrigation in water-scarce fields.
.4	Establish interest groups to practice the above solutions.	<ul style="list-style-type: none"> <li>- Seven interest groups equivalent to seven CSA solutions have been established</li> <li>- Each group has one team leader and meets regularly to share experiences inside and outside the group at the village hall and community library.</li> </ul>	(4) <i>Solution of bio-buffering in chicken production:</i> Over 50% of households raising chickens apply this model with a survival rate up to 99%, finishing phase time is faster and the old biological mattress is replaced after six months and used as a fertilizer for fruit trees and vegetables in the garden.
.5	Technical training in guiding the implementation of CSA solutions	<ul style="list-style-type: none"> <li>- 15 technical training courses were conducted</li> <li>- Organize 15 workshops to share experiences, onshore workshops, and summarize activities</li> </ul>	(5) <i>Integrated garden solution:</i> Even if the garden area in Ma CSV was only applied in seven households, this model has been successfully modeled for one household (Mr. Nguyen Van Kien) with the components grass for livestock + cattle, fruit trees (pomelo, dragon fruit), fresh vegetables, and manure compost. Mr. Kien was selected as the farmer representative for Yen Bai Province to participate in the national conference on overcoming agricultural difficulties in Hanoi in 2018.
.6	Conduct monitoring and evaluation activities (Hoang and Vernooy 2017; Vernooy et al. 2018) on the effectiveness of implementing models with the participation of project partners	<ul style="list-style-type: none"> <li>- Farmers are given a Farmer Handbook to self-evaluate the model's effectiveness through daily recording</li> <li>- Research and management staff conduct periodic and year-end reviews</li> <li>- The number of households practicing the model increases from 10% to over 50% of the total number of agricultural households in the village during the project implementation (as of the end of 2018)</li> </ul>	(6) <i>Solution to set up a concentrated goat stable:</i> reduce the death rate to 0%, increase growth rate, and shorten finishing phase time. This model was learned from a CSV in the Philippines and successfully applied in Ma CSV.  (7) <i>Biogas stoves solution through anaerobic burning from organic waste:</i> This solution is unsuccessful due to the incomplete technical aspects of the biogas stove, the lack of spare parts when it gets broken, lack of enough time to collect waste from agricultural by-products such as sawdust, rice husks, straw.

	ACTIVITIES	RESULTS	PROJECT'S IMPACT
II	<b>Model replication</b>		
.1	Establish a farmer trainers group who has successfully implemented the solutions to train other farmers inside and outside Yen Bai Province (CCAFS 2018).	<ul style="list-style-type: none"> <li>- One village's agricultural extension team, including one commune extension officer and seven farmers, was established;</li> <li>- Conducted three training trips in Cao Bang Province (for nearly 100 households in three communes) and Yen Bai Province (30 households in one commune);</li> <li>- This group of trainers volunteered to participate in future replication activities in Yen Bai, together with the research team of VNUA and CIAT.</li> </ul>	Through the NTM program, the MARD has approved one national science and technology project to build NTMs from 2018-2020 through the VNUA. The project is called <b>Develop a model of Climate-Smart Village adapts to climate change, associated with one commune one product and contributes to building new rural area in the period 2021-2025</b> . It is replicated based on the lessons and experiences in Ma CSV, in which two additional CSVs will be built for the remaining two ecological sub-regions of Yen Bai. This means one set of documents can now be written to guide the construction of CSVs to serve the NTM implementation from 2021-2025.
2	In 2018, the project team successfully introduced the CSV model at the regional and national conferences on NTMs held in Da Nang (July 2018), Dien Bien (July 2018), Vinh Yen (August 2018), and Yen Bai (November 2018) to seek opportunities to integrate the model into the national NTM program	<ul style="list-style-type: none"> <li>- The delegates in the conferences highly appreciated the potential of the model in building the NTMs towards climate change adaptation;</li> <li>- Many delegates proposed the Central NTM Coordinating Office to invest in each province two to three CSVs;</li> <li>- The Central NTM Coordination Office has signed a Memorandum of Understanding (March 9, 2019) with CGIAR organizations to support the construction of NTMs, including the criteria for capacity building to adapt to climate change.</li> </ul>	

## **4. Proposing indicators to integrate climate change adaptation into the set of NTM criteria at the commune level from 2021-2025**

This section aims to propose indicators to support the implementation of some NTM criteria towards climate change adaptation in agricultural production and NTM construction from 2021-2025 (Table 2).

### **4.1. Identify NTM criteria that can integrate climate change adaptation factors into the agricultural production and NTM construction**

Out of a total of 19 NTM criteria, six can be integrated into climate change adaptation in agricultural production:

- Criterion 1: Planning
- Criterion 3: Irrigation
- Criterion 4: Electricity
- Criterion 8: Communication and Telecommunication
- Criterion 13: Production organization
- Criterion 16: Culture

The specific contents of these criteria are specified in Table 2.

### **4.2. Proposing specific adaptation criteria in the set of NTM criteria**

The adaptation indicators are divided into four main groups: (i) CSA solutions; (ii) Climate Services; (iii) Irrigation; and (iv) Adaptation Plan. Each group of these indicators is divided according to sub-indicators to cover the most aspects of climate change adaptation in agricultural production. Among these four groups, group (iv) is at the macro level and covers the planning and implementation of the remaining three groups and requires coordination and linkages between provincial district-commune levels.

It can be seen that the CSV can be applied to implement and achieve the adaptive indicators set for the criteria, as well as throughout the selected NTM criteria (except Criteria 1 - Planning). The use of CSV is a criterion to be achieved at the village level to evaluate the results of implementing climate change adaptation in advanced NTMs and model NTMs. It is also a factor to consider in implementing the NTM adapted to climate change from 2021-2025 (Criteria 16 - Culture).

**Table 3. Proposed indicators to integrate climate change adaptation into the set of NTM criteria at the commune level from 2021-2025**

CRITERIA	CRITERIA CONTENT	INDICATORS INTEGRATE CLIMATE CHANGE ADAPTATION IN BUILDING NTM AT COMMUNE LEVEL IN PERIOD OF 2021-2025										
		(i) CSA Solutions			(ii) Climate Services			(iii) Irrigation			(iv) Adaptation Plan	
		Mitigation	Adaptation	Productivity	Inter-agency cooperation	Information sources	Transfer channels	Inter-level plan	Adaptation solutions	Action plan	Adaptation goals	Province-District-Commune connection
1. Planning	2.1. Having general commune implementation plan approved and publically announced on time										The District People's Committee develops the overall adaptive goals and plans in the NTM based on the conditions and implementation capacity of the communes.	Based on the district plans, the commune develops specific plans and flexible implementation suitable to the local conditions
3. Irrigation	3.1. At least 80% of the total arable land is proactively controlled, irrigated, and drained	Irrigation solutions reduce greenhouse gas emissions, e.g. AWD reduces emissions from wet rice cultivation  (CSV approach for CSA priority setting)	Solutions to increase adaptability, e.g. planting cover crops, soil improvement, building tanks/digging water storage ponds	Solutions to increase productivity in drought conditions, e.g. intercropping legumes to improve soil and increase soil moisture	Similar to Criteria 8			The district develops an irrigation adaptation plan and assigns performance targets to the communes	The commune reviews local capacities and needs to develop specific and appropriate adaptation solutions (CSV approach to choose adaptive solutions)	The district coordinates with communes to develop an overall action program and detailed action programs to improve the effectiveness of the coordination between district and commune.	The District People's Committee develops adaptive irrigation targets and plans across objectives (i) and (ii) in the NTM program based on the conditions and implementation capacity of the communes.	Based on the district's plan, the commune develops a specific irrigation plan and deploy it flexibly according to the conditions of each locality.
4. Electricity	4.1. Electrical system meets standards	Evaluate the potential development of renewable energy sources (e.g., wind, solar, wave) for adaptive agricultural solutions to reduce the pressure on the national grid and save cost (CSV approach to assess the potential and the need to adopt new solutions)						Evaluate the potential development of renewable energy sources (e.g., wind, solar, wave) for adaptive irrigation activities to reduce the pressure on the national grid and save cost (CSV approach to assessing the potential and the need to adopt new solutions)			The District People's Committee develops adaptive electricity use targets and plans across the objectives (i), (ii), and (iii) of the NTM program based on the conditions and implementation capacity of the commune	Based on the district's plans, the commune develops specific electricity use plans and deploy them flexibly per local conditions
8. Communication and Telecommunication	8.2. Commune has telecommunication services, internet				Centre for Hydro-Meteorological Forecasting							
	8.3. Commune has radio and loudspeaker system reaching all villages	Aside from direct technical training, the technical recommendations on solutions to mitigate, adapt, and improve productivity were conveyed to the people through the loudspeaker system at the commune and village levels. (CSV approach to communication method)			Provincial Hydro-meteorological Station and Agricultural Extension Center	Provincial meteorological station; Regional meteorological stations; Weather forecast news on television; Reliable weather forecast information on the internet	Weather bulletin board at commune and village levels Daily weather forecast through commune and village loudspeaker  Computer systems connected to the internet at commune			Aside from direct technical training, the technical recommendations on irrigation solutions and the implementation coordination plan were conveyed to villagers through the loudspeaker system at the commune and village levels. (CSV approach to communication method)	The District People's Committee develops adaptive communication and information targets and plans across the targets (i), (ii), and (iii) of the NTM program based on the conditions and implementation capacity of communes	Based on the district's plan, the commune plans to implement specific information and communication targets and flexibly deploy them according to the conditions of each locality.
	8.4. Commune applied information technology in management and operation				District Agriculture Division and Agricultural Extension Station Commune People's Committee							



						and village levels					
13. Production Organization	13.1. Commune has operating cooperatives based on the provisions of the Cooperative Law 2012	Applying technical solutions to OCOP products to ensure climate change mitigation and adaptation, as well as mutual linkage between solutions/models. This ensures climatic and environmental sustainability in value chain development <i>(Climate-Smart Village approach to CSA solutions)</i>	Development of OCOP products	Similar to Criteria 8			The commune's plan is detailed from the district's overall development plan and suitable for local conditions	The selection of solutions is implemented in residential communities using the CSV approach	The action plan is developed towards the participation of all stakeholders following the model of CSV	The District People's Committee develops targets and plans to implement adaptive production organization activities across the targets (i), (ii), and (iii) of the NTM program based on conditions and the communes' capability to implement	Based on the district's plan, the commune plans to implement specific production organization activities and deploy them flexibly following the conditions of each locality.
	13.2. Commune has sustainable production linkage model associated with major agricultural product consumption										
16. Culture		<ul style="list-style-type: none"><li>Commune and village cultural institutions need to be secured to help people access, seek, exchange, and share experiences on adaptation indicators (i), (ii), (iii) and (iv), including:<ul style="list-style-type: none"><li>Community libraries at the commune and village levels</li><li>Agricultural extension and climate bookcases</li><li>Weather/policies/season bulletin board</li><li>Propagation loudspeaker system</li></ul><i>(CSV approach to communication solutions)</i></li><li>Develop a set of indicators to evaluate the level of implementation of climate change adaptation at commune and village levels for localities striving to achieve advanced NTMs and model NTMs:<ul style="list-style-type: none"><li>The title of CSV for villages that effectively implement cultural institutions for climate change adaptation activities</li><li>Percentage of villages achieving the title of CSV for advanced communes</li><li>Percentage of villages achieving the title of CSV for model communes</li></ul></li></ul>								The District People's Committee develops targets and plans on cultural activities to support the implementation of adaptation activities throughout the targets (i), (ii), and (iii) of the NTM program based on conditions and implementation capacity of communes	Based on the district's plan, the commune plans to implement specific cultural activities and flexibly implement them according to the conditions of each locality.

(Sources: VNUA and CIAT research group)

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